

運用專利資訊分析前瞻技術發展趨勢：

以奈米碳管場發射顯示技術為對象

Using patent analyses to monitor the technological trends in an  
emerging field of technology:

The case of carbon nanotube field emission display technology

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### 中文摘要

專利是技術與商業資訊的豐富來源，藉由專利資訊可探索技術趨勢，改善技術發展。奈米碳管場發射顯示器（Carbon nanobute field emission display; 簡稱 CNT-FED）為新興的奈米應用科技與革命性的新型顯示器，其發射源材料奈米碳管（Carbon nanobute; 簡稱 CNT）的製備在 CNT-FED 的製程中更是扮演著重要的角色。然而，CNT-FED 的技術與 CNT 的製備仍有若干的技術瓶頸必須克服。因此，在進一步的技術發展之前，運用專利資訊分析 CNT-FED 技術與 CNT 製備的狀態與趨勢實為重要的研究議題。

本研究使用書目計量分析與專利網絡分析探討 CNT-FED 技術與 CNT 製備之技術狀態與技術趨勢。首先，運用書目計量分析探究 CNT-FED 技術與 CNT 製備之技術發展路徑與目前技術狀態。其次，運用專利網絡分析分別繪製 CNT-FED 技術與 CNT 製備的專利網絡圖。接著，使用集群分析將專利網絡圖中的所有專利區隔成為若干個集群。最後，根據分析結果找出關鍵技術與技術發展趨勢。

本研究顯示了許多關於 CNT-FED 技術與 CNT 製備方面重要的分析結果。在 CNT-FED 技術方面，分析結果指出，製造 CNT-FED 的三大關鍵技術分別為在基板上成長 CNT、於螢幕上塗佈螢光粉及元件組裝程序，CNT-FED 的技術發展趨勢在於 CNT 材

料的合成。在 CNT 製備方面，分析結果指出，製備 CNT 材料的關鍵技術包括採用不同的方法提升 CNT 的特性與使用化學氣相沈積法 (Chemical vapor deposition; 簡稱 CVD) 在各種基板上成長 CNT，CNT 製備的技術發展趨勢在於 CVD 的技術，尤其是在製造以 CNT 為基礎的元件上，CVD 技術扮演著重要的角色。

除了分析結果之外，專利分析方法在本研究中亦扮演著重要的角色。書目計量分析可協助研究者易於瞭解某項技術的發展狀態。另一方面，專利網絡分析使得研究者能夠直覺地瞭解該技術領域中一系列專利的全貌。這些方法有助於分析技術狀態與趨勢，並且對於前瞻技術的探索提供了一個有利的途徑。

關鍵詞：專利、書目計量分析、專利網絡分析、奈米碳管、奈米碳管場發射顯示器。



# Using patent analyses to monitor the technological trends in an emerging field of technology:

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### Abstract

Because patents are rich sources of technological and commercial information, the technological trends can be easily monitored to improve the developments of technology. Carbon nanotube field emission display (CNT-FED) represents both emerging application of nanotechnology and revolutionary invention of display. Especially, fabricating the emitter materials, which are called carbon nanotubes (CNTs), plays an important role in the manufacturing process of CNT-FED. However, there are several technological bottlenecks need to be overcome before further progress in CNT-FED technology and CNT fabrication. Therefore, it is an important subject to use patent analysis to monitor the states and trends of CNT-FED technology and CNT fabrication before the next stage of development.

The present paper uses patent bibliometric analysis and patent network analysis to monitor the technological states and trends of CNT-FED and CNT fabrication. First, Patent bibliometric analysis are employed to find the developmental path and current states of CNT-FED technology and CNT fabrication. Second, the network graphs of patents regarding

CNT-FED technology and CNT fabrication respectively are drawn by using patent network analysis. And then, cluster analysis can be used to sort all patents within patent network into several clusters. Finally, the critical technologies and technological trends can be identified based on the results of analyses.

This study reveals a lot of important outcomes in CNT-FED technology and CNT fabrication. In the CNT-FED technology, the results indicate that deposition of CNT on substrate, coating phosphor on screen, and assembling process for whole device are three critical technologies for manufacturing CNT-FED. The developing trend of CNT-FED technology focuses on the synthesis of CNT materials. In the CNT fabrication, the results indicate that the critical technologies for fabricating the CNT based materials contain that enhancing the characteristic of CNT with various methods and producing CNT by chemical vapor deposition (CVD) technique on various substrates. The main developing trend of CNT fabrication focuses on CVD technique. Especially, the CVD technique plays an important role for manufacturing CNT based device.

In addition to the analytical of results, the methodologies of patent analyses play an important role in this study. Patent bibliometric analysis assists the researchers in easily understanding the developmental states of the subject technology. On the other hand, patent network analysis enables the researchers to intuitively comprehend the overview of a set of patents in the field of the technology being studied. The fruitful methodologies are helpful for the analyses of technological states and trends, as well as offer a useful avenue to monitor the emerging technology.

**Keywords:** Patent, Patent bibliometric analysis, Patent network analysis, Carbon nanotubes (CNTs), Carbon nanotube field emission display (CNT-FED).

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